

Chapter 11 Worksheet

The following molecules are gases at room temperature: Ne, N₂, O₂, Cl₂, and SiH₄. Which one will have the highest boiling point?

- a) Ne b) N₂ c) O₂ d) Cl₂ e) SiH₄

Ideally, colligative properties depend only on

- a) the identity of the solute in a solution.
b) the number of solute particles per solvent molecule in a solution.
c) the temperature of a solution.
d) the charge of the ions dissolved in solution.
e) the gas pressure above the surface of a solution.

What is the molality of Na⁺ ions in a 6.29% by mass Na₂CO₃ solution? The molar mass of sodium carbonate is 105.99 g/mol.

- a) 0.134 *m* b) 0.593 *m* c) 1.04 *m* d) 1.19 *m* e) 1.27 *m*

Concentrated sulfuric acid is 18.0 M and 96.0% H₂SO₄ by mass. What is the density of concentrated sulfuric acid?

- a) 0.825 g/mL b) 0.960 g/mL c) 1.37 g/mL d) 1.77 g/mL e) 1.84 g/mL

The Henry's law constant for N₂ in water at 25 °C is 8.4×10^{-7} M/mm Hg. What is the equilibrium concentration of N₂ in water when the partial pressure of N₂ is 653 mm Hg?

- a) 1.3×10^{-9} M b) 7.2×10^{-7} M c) 5.5×10^{-4} M d) 3.1×10^{-2} M e) 7.8×10^8 M

Which of the following aqueous solutions should have the lowest freezing point?

- a) pure H₂O b) 1 *m* CaBr₂ c) 1 *m* NH₃ d) 1 *m* NaNO₃ e) 1 *m* C₆H₁₂O₆

What is the freezing point of a solution containing 5.663 grams naphthalene (molar mass = 128.2 g/mol) dissolved in 32.0 grams paradichlorobenzene? The freezing point of pure paradichlorobenzene is 53.0 °C and the freezing point depression constant, K_{fp} , is -7.10 °C/*m*.

- a) 43.2 °C b) 47.0 °C c) 51.7 °C d) 53.0 °C e) 69.1 °C

What mass of NaCl must be dissolved in 75.0 grams of water to lower the freezing point to -4.00 °C? The freezing point depression constant, K_{fp} , for water is -1.86 °C/*m*. Assume the van't Hoff factor for NaCl is 2.00.

- a) 1.02 g b) 2.04 g c) 2.35 g d) 4.71 g e) 9.43 g

Which of the following is an example of osmotic pressure?

- a) salting icy roads
- b) salting meats for preservation
- c) pressurizing soda with carbon dioxide
- d) mixing water and ethylene glycol in anti-freeze
- e) distilling alcohol

A solution is prepared by mixing 0.0300 mols of CH_2Cl_2 and 0.0500 mols of CH_2Br_2 at 25°C . Assuming the solution is ideal; calculate the composition of the vapor (in terms of mole fractions) at 25°C . At 25°C , the vapor pressures of pure CH_2Cl_2 and pure CH_2Br_2 are 133 and 11.4 torr, respectively. (#50)

An unknown compound contains C, H, and O. Combustion analysis of the compounds gives mass % of: 31.57% C and 5.30% H. The molar mass is determined by measuring the freezing point of -5.20°C is recorded for a solution made by dissolving 10.56 g of the compound in 25.0 g water. Determine the empirical formula, molar mass, and molecular formula of the compound. Assume that the compound is a nonelectrolyte. (#83)

A solid mixture contains MgCl_2 and NaCl . When 0.5000 g of this solid is dissolved in enough water to form 1.000 L of solution, the osmotic pressure at 25.0°C is observed to be 0.3950 atm. What is the mass % of MgCl_2 in the solid? Assume ideal behavior. (#90)

Na_2CO_3 6.29% mass.

100 g total = solute + solvent

6.29 g of $\text{Na}_2\text{CO}_3 \rightarrow 0.0593$ mols

93.71 g H_2O

$$\frac{0.1187 \text{ mols Na}^+}{0.09371 \text{ kg}} = 1.27$$

18 M H_2SO_4

$$d = \frac{\text{Mass}}{\text{Vol.}}$$

96% H_2SO_4

100 g total

96 g H_2SO_4

4 g solvent

18 M =

1 L of solution

18 mols H_2SO_4

$\hookrightarrow 1764 \text{ g/mol}$

$$\frac{96}{100} = \frac{1764}{x}$$

$$x = 1837.5 \text{ g}$$

$$d = \frac{1837.5 \text{ g}}{1000 \text{ mL}} =$$

$$1.8375 \text{ g/mL}$$

$$S = P \cdot K_H$$

$$S = (653)(8.4 \times 10^{-7})$$

$$S = 5.5 \times 10^{-4} \text{ M}$$

B because more ions

$$\Delta T = k \cdot m \cdot i$$

$$\frac{0.0442 \text{ mols}}{0.032} \cdot i = 1.38$$

$$\Delta T = (-7.10)(1.38) = -9.8$$

$$53 - 9.8 = 43.2$$

$$\Delta T = K \cdot m \cdot i$$

$$-4 = (-1.86)(m)(2)$$

$$m = 1.075$$

~~1.075 = m = \frac{x}{0.075}~~

$$x = 0.0806 \text{ mols}$$

$$\rightarrow x \times 58 \text{ g/mol} = 4.7 \text{ g}$$

B because it must remove the H_2O to preserve

0.0300 mols CH_2Cl_2 } solution
0.0500 mols CH_2Br_2 }

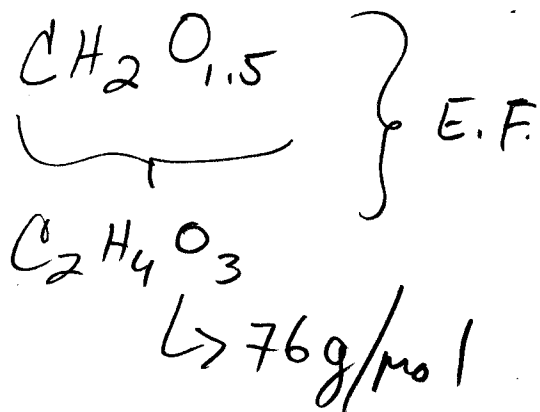
$$\therefore \begin{array}{r} \underline{\chi} \\ 0.375 \text{ } \text{CH}_2\text{Cl}_2 \\ 0.625 \text{ } \text{CH}_2\text{Br}_2 \end{array} \quad \begin{array}{r} \underline{P(\text{vapor})} \\ 49.875 \\ 7.125 \end{array}$$

$$P = \chi \cdot P^\circ$$

$$\frac{49.875}{57} = 0.875 = \chi_{\text{CH}_2\text{Cl}_2}$$

$$\chi_{\text{CH}_2\text{Br}_2} = 0.125$$

<u>%</u>	<u>mols</u>
31.57 C	2.63
5.30 H	5.30
63.13 O	3.96

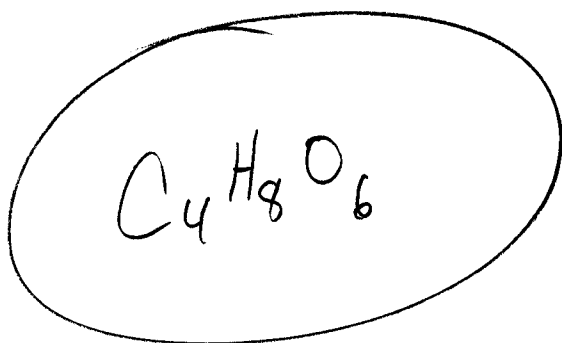


$$\Delta T = K \cdot m \cdot i$$

$$\begin{array}{l}
 -5.20 = -1.86 \text{ m} \\
 m = 2.80 = \frac{\text{mols Solute}}{\text{Kg Solue}} = \frac{X}{0.025 \text{ Kg}}
 \end{array}$$

$$X = 0.0699 \text{ mols}$$

$$\frac{10.56 \text{ g}}{0.0699 \text{ mols}} = 151 \text{ g/mol} = \text{M.W.}$$



$$\pi = cRT \cdot i$$

$$0.3950 = c(0.082057)(298)$$

$$c = 0.0162 \text{ M}$$

$$\therefore 0.0162 \text{ mols}$$

$$0.0162 \text{ mols} = \frac{3X}{95.21} + \frac{2Y}{58.44}$$

$$X + Y = 0.500 \text{ g}$$

$$X = 0.50 - Y$$

$$0.0162 = \frac{1.5 - 3Y}{95.21} + \frac{2Y}{58.44}$$

$$0.0162 = \frac{87.66 - 175.32Y + 190.42Y}{5564.6724}$$

$$2.477 = 15.1Y$$

$$Y = 0.164 \text{ g (NaCl)}$$

$$\therefore 0.336 \text{ g MgCl}_2$$

$$\frac{0.336 \text{ g}}{0.50} \times 100 = 67.2\%$$

67.2%